15. Magnetic Field Dependence of Far Infrared Transmission Spectra of Superconducting Bi-Sr-Ca-Cu-O Thin Films

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Transmission spectra of superconducting thin films were measured in the far-infrared region. The sample is $Bi_2Sr_2CaCu_2O_8$ thin film (Tc～82K) deposited on MgO substrate. Magnetic field(～5Tesla) was applied to the sample to observe its effect on the spectra. In order to carry out this measurement, in the range from 30 to 300 cm^{-1} we employed a Michelson Fourier transform interferometer.

By this experiment, we had a clear field dependence of transmission spectra. That is to say, its ratio spectrum, $T(H)/T(0)$, gives a threshold which seems to be an optical gap, and it decreased with increasing magnetic field. Using the theoretical relation of normalized optical gap to external magnetic field per the upper critical field, we determined the optical gap $\Omega_g(0)$～$220cm^{-1}$ at zero magnetic field, and the upper critical field, H_{c2}～38 Tesla.

From qualitative features of the magnetic field dependence, we concluded that this material is a weak-coupling superconductor as shown in the following relation,

$$2\Delta/k_BT_c \sim 3.9.$$